

WHAT IS CLAIMED IS:

1. A method for operating a gas turbine engine, including a first compressor, a second compressor, and a turbine, coupled together in serial flow arrangement, said method comprising:

channeling compressed airflow discharged from the first compressor through an intercooler having a cooling medium flowing therethrough;

operating the intercooler such that condensate is formed in the intercooler from the compressed airflow; and

channeling the condensate to an inlet of the second compressor to facilitate reducing an operating temperature of the gas turbine engine.

2. A method in accordance with Claim 1 wherein said intercooler comprises a drain valve, said method further comprises channeling the condensate through the drain valve to a first storage tank.

3. A method in accordance with Claim 2 further comprising channeling the condensate from the storage tank, through a first pump, to a demineralizer.

4. A method in accordance with Claim 3 further comprising channeling the condensate from the demineralizer to a demineralizer holding tank.

5. A method in accordance with Claim 4 further comprising channeling the condensate from the demineralizer holding tank to the second compressor using a second pump that is different than the first pump.

6. A method in accordance with Claim 1 wherein channeling the condensate to an inlet of the second compressor further comprises channeling

condensate through an injection assembly coupled to the inlet of the second compressor.

7. A method in accordance with Claim 1 wherein channeling the condensate to an inlet of the second compressor further comprises channeling condensate to the inlet of the second compressor at a predetermined rate.

8. A method in accordance with Claim 1 wherein channeling condensate to an inlet of the second compressor comprises channeling condensate through an injection system including a plurality of circumferentially spaced injectors, to the inlet of the second compressor at a predetermined rate.

9. A cooling system for a gas turbine engine that includes at least a first compressor, a second compressor, and a turbine, said cooling system comprising:

an intercooler coupled downstream from the first compressor such that compressed air discharged from the first compressor is routed therethrough, said intercooler having a working fluid flowing therethrough; and

an injection system coupled in flow communication with said intercooler, said injection system configured to channel condensate formed in said intercooler into the second compressor to facilitate reducing an operating temperature of the gas turbine engine.

10. A cooling system in accordance with Claim 9 further comprising a condensate holding tank in flow communication with said intercooler, said condensate holding tank configured to receive said condensate formed in said intercooler.

11. A cooling system in accordance with Claim 10 further comprising a first pump coupled in flow communication with said condensate holding tank.

12. A cooling system in accordance with Claim 11 further comprising a demineralizer, said first pump directs said condensate through said demineralizer to a demineralizer holding tank.

13. A cooling system in accordance with Claim 12 further comprising a second pump, different than said first pump, in flow communication with said demineralizer holding tank, said second pump configured to channel condensate from said demineralizer holding tank to said condensate injection system.

14. A cooling system in accordance with Claim 9 wherein said condensate injection system comprises a plurality of injectors positioned circumferentially around an outer periphery of said second compressor.

15. A cooling system in accordance with Claim 9 wherein said injection system is configured to channel condensate formed in said intercooler into said second compressor at a predetermined rate.

16. A gas turbine engine comprising:

a first compressor;

a second compressor downstream from said first compressor;

a turbine coupled in flow communication with said second compressor;

and

a cooling system comprising:

an intercooler coupled downstream from said first compressor such that compressed air discharged from said first compressor is routed therethrough, said intercooler having a working fluid flowing therethrough; and

a condensate injection system coupled in flow communication with said intercooler, said condensate injection system configured to channel condensate

formed in said intercooler into said second compressor to facilitate reducing a temperature of said gas turbine engine.

17. A gas turbine engine in accordance with Claim 16 wherein said cooling system further comprises a condensate holding tank in flow communication with said intercooler, said condensate holding tank configured to receive said condensate formed in said intercooler.

18. A gas turbine engine in accordance with Claim 16 wherein said cooling system further comprises:

a first pump coupled in flow communication with said condensate holding tank;

a demineralizer in flow communication with said first pump; and

a demineralizer holding tank in flow communication with said demineralizer, said first pump directs said condensate through said demineralizer to said demineralizer holding tank.

19. A gas turbine engine in accordance with Claim 16 wherein said injection system further comprises a plurality of injectors positioned circumferentially around an outer periphery of said second compressor.

20. A gas turbine engine in accordance with Claim 16 wherein said injection system further comprises a plurality of injectors configured to channel a condensate formed in said intercooler into said second compressor at a predetermined rate.

21. A cooling system for a gas turbine engine that includes at least a first compressor, a second compressor, and a turbine, said cooling system comprising:

an intercooler coupled downstream from the first compressor such that compressed air discharged from the first compressor is routed therethrough, said intercooler having a working fluid flowing therethrough; and

an injection system coupled in flow communication with said intercooler, said injection system configured to channel condensate formed in said intercooler into the first compressor to facilitate reducing an operating temperature of the gas turbine engine.

22. A cooling system in accordance with Claim 21 wherein said injection system is configured to channel a condensate formed in said intercooler into a low pressure compressor.

23. A cooling system in accordance with Claim 22 further comprising a condensate holding tank in flow communication with said intercooler, said condensate holding tank configured to receive said condensate formed in said intercooler.

24. A cooling system in accordance with Claim 23 further comprising a first pump coupled in flow communication with said condensate holding tank.

25. A cooling system in accordance with Claim 24 further comprising a demineralizer, said first pump directs said condensate through said demineralizer to a demineralizer holding tank.

26. A cooling system in accordance with Claim 25 further comprising a second pump, different than said first pump, in flow communication with said demineralizer holding tank, said second pump configured to channel condensate from said demineralizer holding tank to said condensate injection system.

27. A cooling system in accordance with Claim 21 wherein said condensate injection system comprises a plurality of injectors positioned circumferentially around an outer periphery of said first compressor.